



# **Propellant and Performance Fluid: Low Environmental Impact Products for Aerosol Formulation**

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**Honeywell**

## Propellant Selection



### Performance Criteria

- Liquefied Gas versus Compressed Gas
- Vapor Pressure
- Miscibility/Compatibility with Solvents and Active Ingredients
- Compatibility with Packaging Components

### Safety Criteria

- Low Toxicity
- Nonflammable Propellants Required or Preferred in Some Products
  - Freeze Sprays, Some Dusters, Novelties, Insecticides, Tire Inflators

**Several Factors Drive Propellant Choice**

# Propellant Selection: Environmental Criteria

## U.S. VOC Regulations May Limit Propellant Options



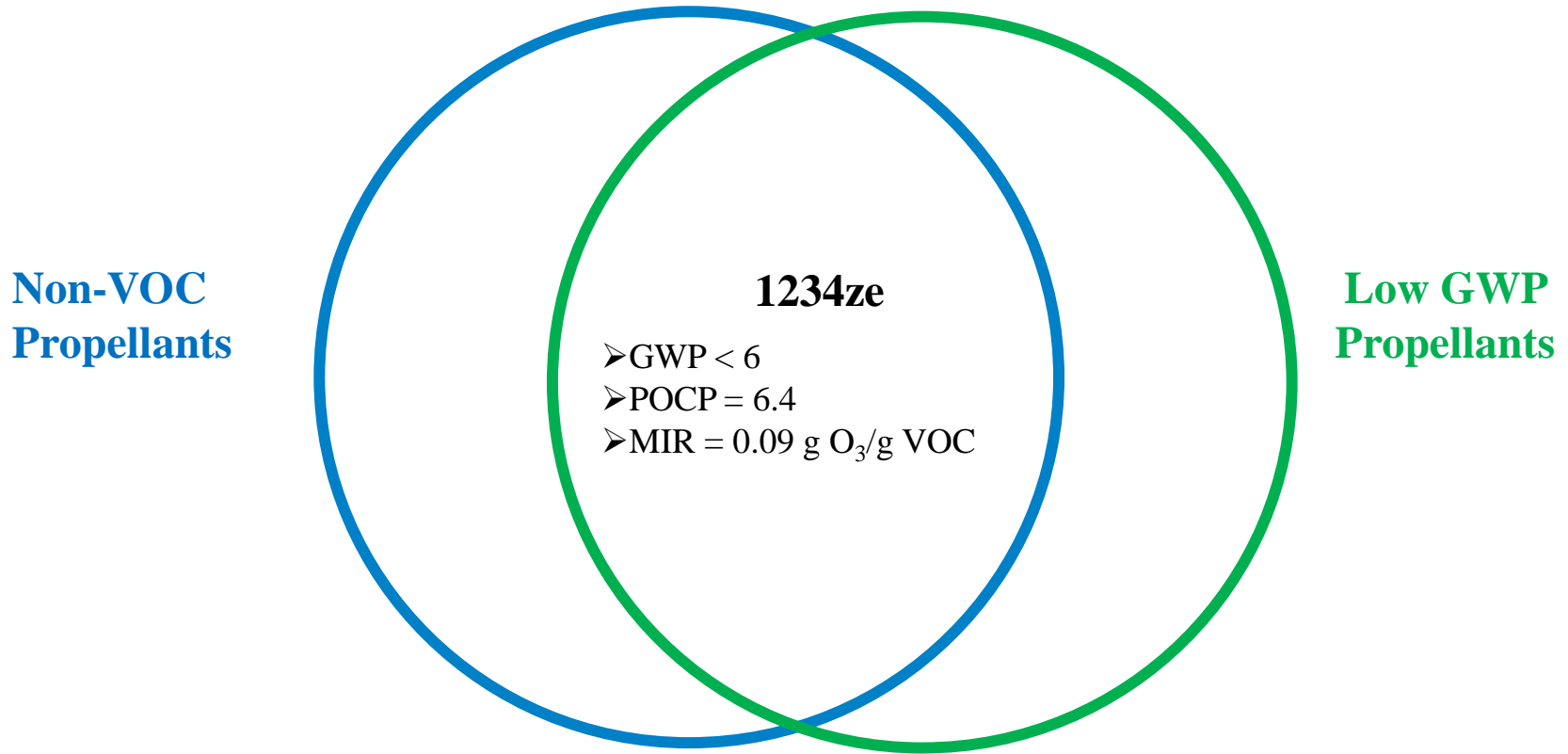
Classified as VOCs in the U.S	Not Classified as VOCs in the U.S.
Hydrocarbons	1234ze
DME	152a
	134a

Greenhouse Gas Regulations, Carbon Taxes and Corporate Green Initiatives drive interest in Low GWP Propellants

**VOC and GWP Status Influence Propellant Choice**

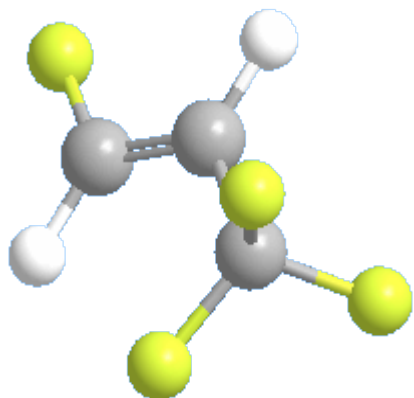
# 1234ze Environmental Properties

*Generally, Propellants Have Low Reactivity or Low GWP but Not Both; 1234ze is an Exception*



**Best Combination of Environmental Properties**

# 1234ze



1,3,3,3-tetrafluoropropene

## Performance

- Medium Pressure: (3.4 Bars at 21<sup>0</sup> C)
- Good Compatibility, Stability, Miscibility

## Safety

- Nonflammable
- Very Low Order of Toxicity
- OEL 800 PPM

## Environmental

- Best Overall Combination of Environmental Properties
- GWP <6 (100-year ITH)
  - A Recent Publication Reports <1
- Very Low MIR and POCP Values
  - U.S. EPA VOC Exempt

**An Additional Option for Formulators**

## 1234ze Compatibility with Packaging Materials



### Valve Compatibility Studies

- Carried Out By Aptar, Precision and Summit
- Buna, Butyl and EPDM Generally Good
- Mixed Results with Neoprene Depending on Grade
- High Swell with Viton

### Compatible With

- Tinplate Steel Cans
- Lined Aluminum Cans
  - PET
  - Epoxy
  - PAM
  - New PAM Alternative (PPG)

**Compatible with Most Aerosol Package Components**

## 1234ze

### Stability, Chemical Compatibility and Solubility



- Thermally Stable (Tested up to 200<sup>0</sup> C)
- Hydrolytically Stable (Does not mix with water but stable in the presence of water)
- Compatible with Many Formulation Ingredients Including Alcohols and Aluminum Chlorohydrate (Honeywell Study)
  - Caution with High pH Environments and with Certain Amines
- Miscible with:
  - Other Propellants: HCs, DME, 152a, 134a
  - Lower Alcohols: MeOH, EtOH, IPA, etc.,
  - Hydrocarbon Solvents
  - Halocarbon Solvents

**Good Stability, Compatibility, Miscibility**

## 1234ze Impact on Carbon Footprint

An Organization's (or Individual's) "Carbon Footprint" is a Measure of CO<sub>2</sub> or CO<sub>2</sub>-Equivalent Emissions

**Carbon footprint of 200 ml 134a duster**



**Carbon footprint of 200 ml 1234ze duster**



Replacing 1 can of 134a duster with 1 can of 1234ze duster results in a 347.5 Kg reduction in CO<sub>2</sub> – Equivalent emissions

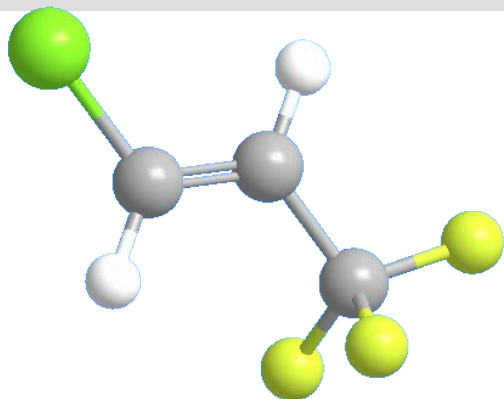
This is equivalent to:

- 2896 fewer Km driven – Approximately the distance from Berlin (Germany) to Malaga (Spain)
- reducing temperature by 1.7°C for the winter season in a natural gas heated home

**Reducing CO<sub>2</sub> Emissions Contributes to Sustainability**



# 1233zd Performance Fluid (Solvent)



1-chloro-3,3,3-trifluoro  
-propene

## Performance

- High Degree of Solvency
  - KB Value 25
- Thermally and Hydrolytically Stable
- Good Materials Compatibility

## Safety

- Nonflammable
- Very Low Order of Toxicity
  - OEL 800 PPM

## Environmental

- Excellent Combination of Environmental Properties
- GWP <5 (100-year ITH), A Recent Publication Reports 1
- Very Low MIR and POCP Values

**A New Solvent for Aerosols**

## Functionality



- Excellent Solvency for a Wide Variety of Solutes
  - Mineral Oil and Other Hydrocarbon Oils
  - Silicone Oils, Silicone Greases
  - Soy Lecithin
  - Fluorinated Oils, Refrigerant Oils
  - Acrylics
  - Solder Fluxes, Hydraulic Fluids
  - Essential Oils
- Low Surface Tension Provides Excellent Wetting
- Useful as an Aerosol (Cleaning) Solvent
- Carrier Solvent for Mold Releases, etc.

**Multiple Possible Uses**

# Regulatory



EU: REACH registered for 10 tons

- > 1000 Tonnes by End of 2013

Registered in Canada, Approved for Use in Japan, South Korea

- Other Registrations Underway

On the U.S. TSCA Inventory (Jan 2012)

- Added to the EPA SNAP list of acceptable substitutes for ozone depleting substances as an aerosol solvent (Aug. 2012)
- U.S. EPA VOC Exemption (August 2013)

**Commercially Available**

## QUESTIONS?

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